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Han et al.

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(54) **TRAY FOR ALIGNING SEMICONDUCTOR PACKAGES AND TEST HANDLER USING THE SAME, AND METHOD OF ALIGNING SEMICONDUCTOR PACKAGES AND TEST METHOD USING THE SAME**

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H01L 21/673 (2006.01)
H01L 21/68 (2006.01)

(52) **U.S. Cl.**
CPC **G01R 31/2893** (2013.01); **H01L 21/67333** (2013.01); **H01L 21/68** (2013.01)

(58) **Field of Classification Search**
None
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,029,427 A *	2/2000	Freund	.....	H01L 21/67333	206/460
2008/0071409 A1 *	3/2008	Ahn	.....	G01R 31/2893	700/114
2008/0157807 A1 *	7/2008	Kim	.....	G01R 31/2893	324/750.22
2008/0174299 A1 *	7/2008	Kim	.....	G01R 31/2867	324/756.07
2011/0316571 A1 *	12/2011	Kiyokawa	.....	G01R 31/2891	324/750.16
2012/0062258 A1 *	3/2012	Yamada	.....	G01R 31/2887	324/750.16
2012/0062262 A1 *	3/2012	Lee	.....	G01R 31/2893	324/757.04
2013/0181576 A1 *	7/2013	Shiozawa	.....	H02N 2/0095	310/323.17

FOREIGN PATENT DOCUMENTS

KR	19960008967	3/1996
KR	19960024298	7/1996
KR	0269228	7/2000
KR	1084606	4/2001
KR	0375302	2/2005
KR	0565783	11/2005
KR	20080109226	12/2008
KR	1113710	3/2011

* cited by examiner

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(57) **ABSTRACT**

A tray for aligning semiconductor packages, a test handler using the same, a method of aligning the semiconductor packages, and a test method using the same include a tray main body comprising a plurality of package pocket portions at which a plurality of semiconductor packages are individually received and an air position-aligning unit coupled to the tray main body. The air position-aligning unit applies air having a preset pressure to the semiconductor package received at the package pocket portion. The semiconductor package is aligned at the package pocket portion.

24 Claims, 9 Drawing Sheets

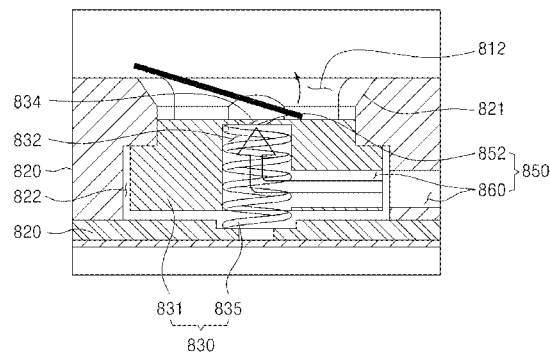


FIG. 1

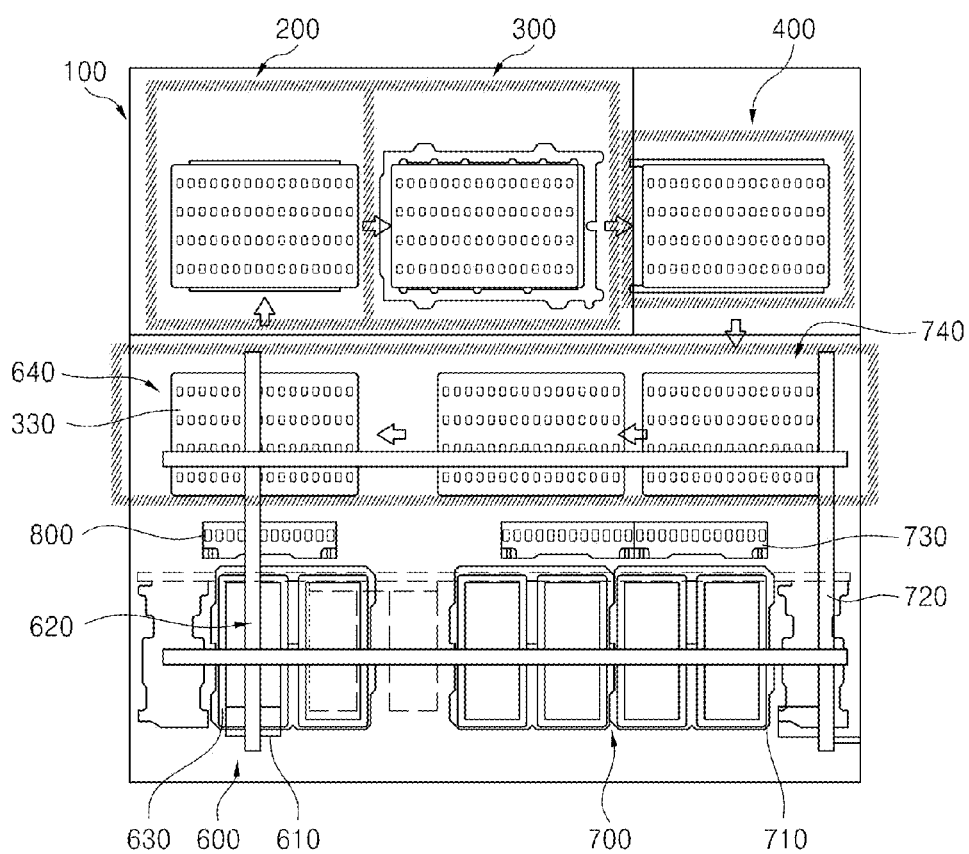


FIG. 2

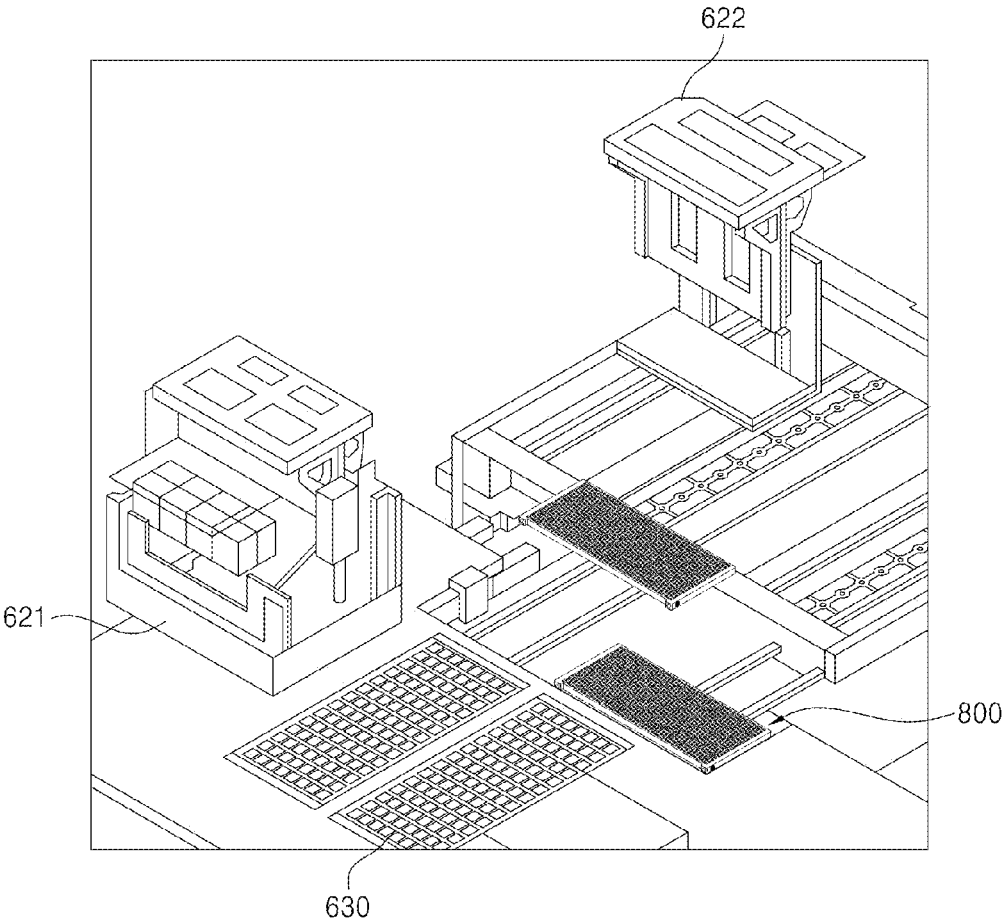


FIG. 3

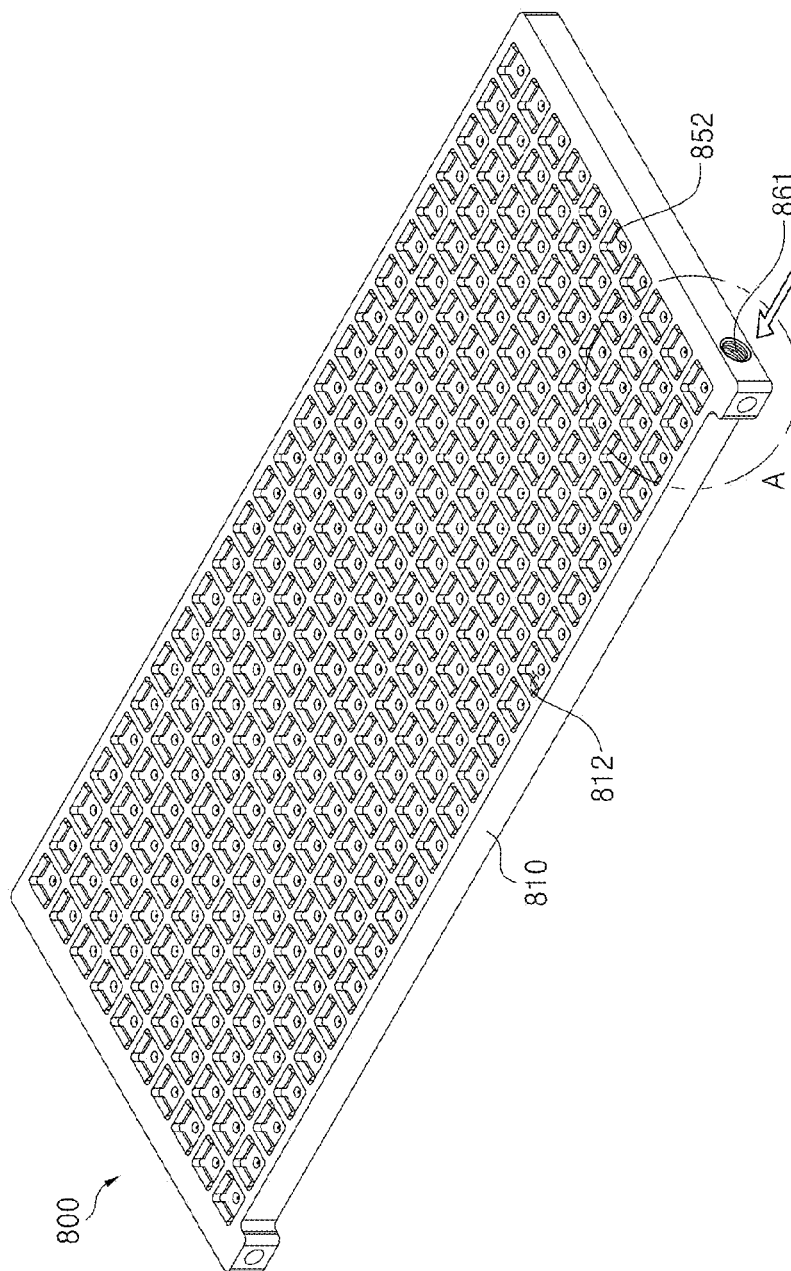


FIG. 4

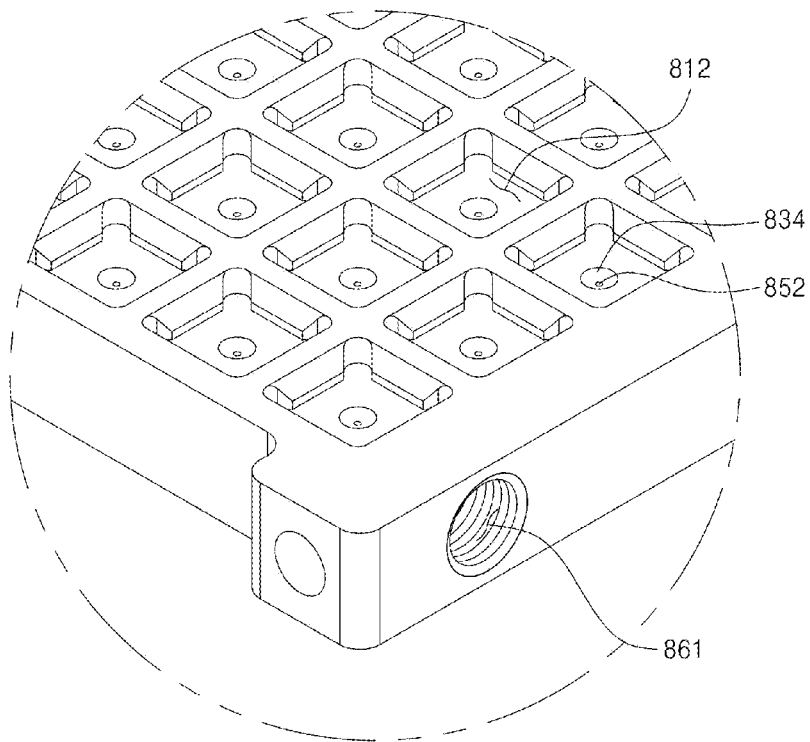


FIG. 5

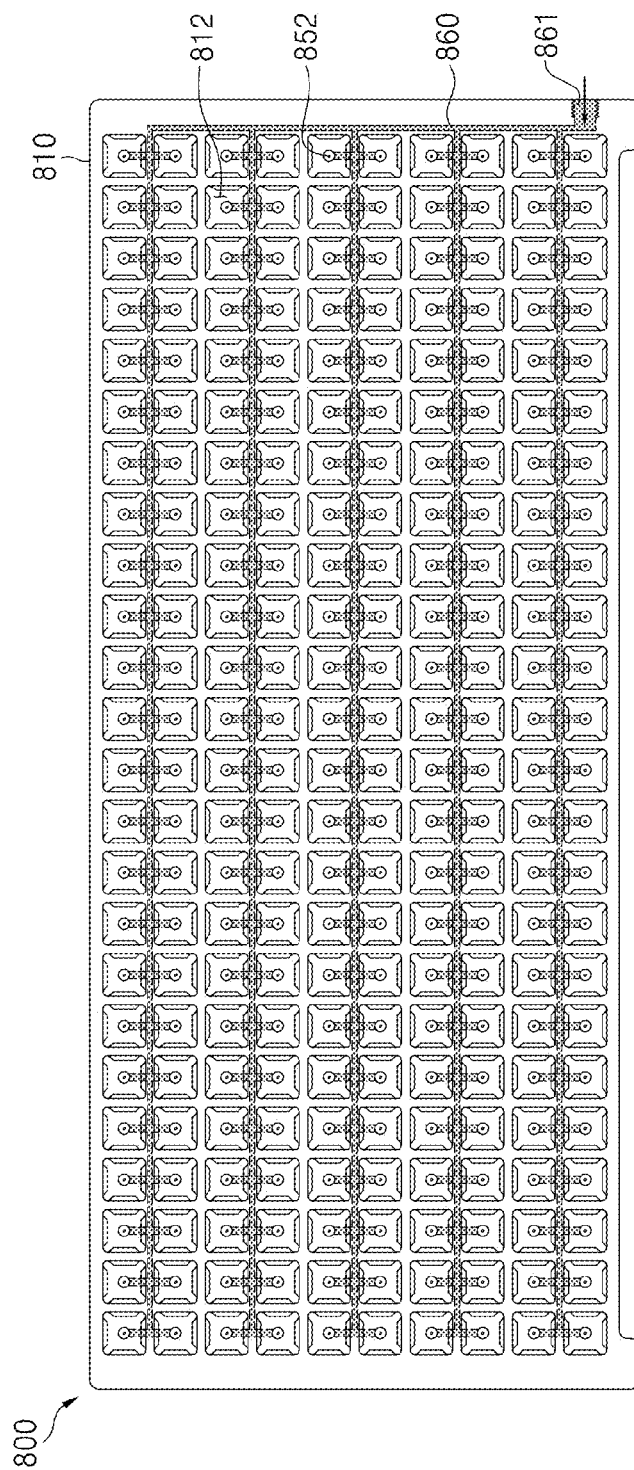


FIG. 6

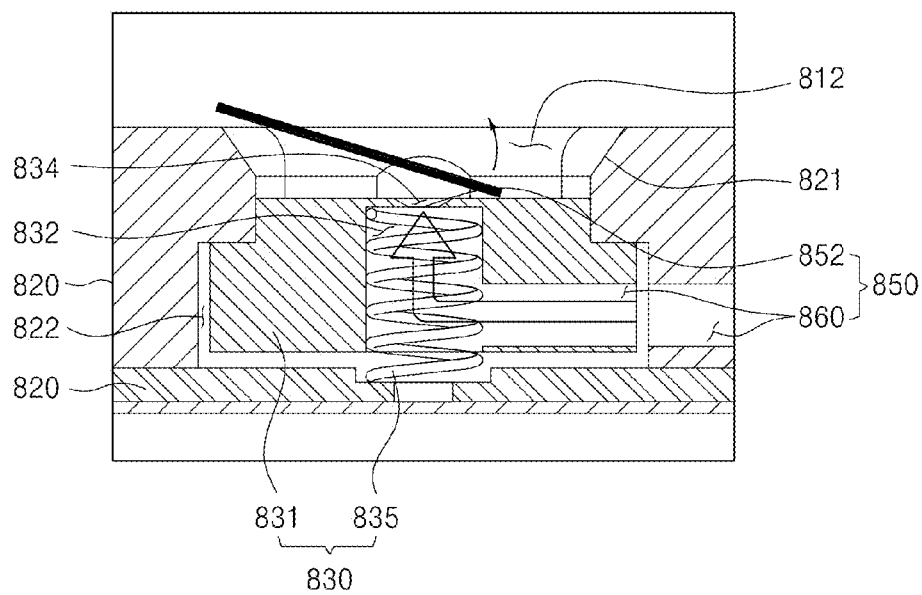


FIG. 7

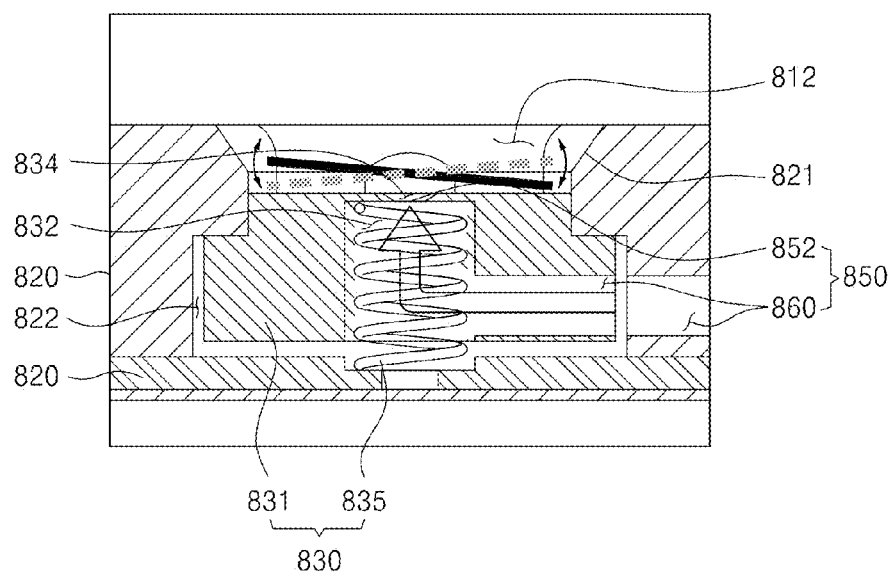


FIG. 8

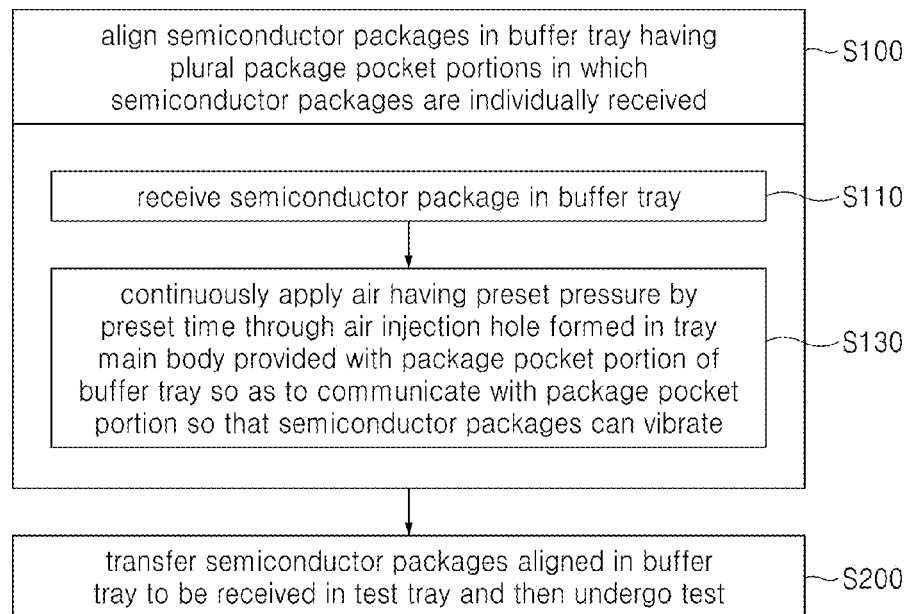
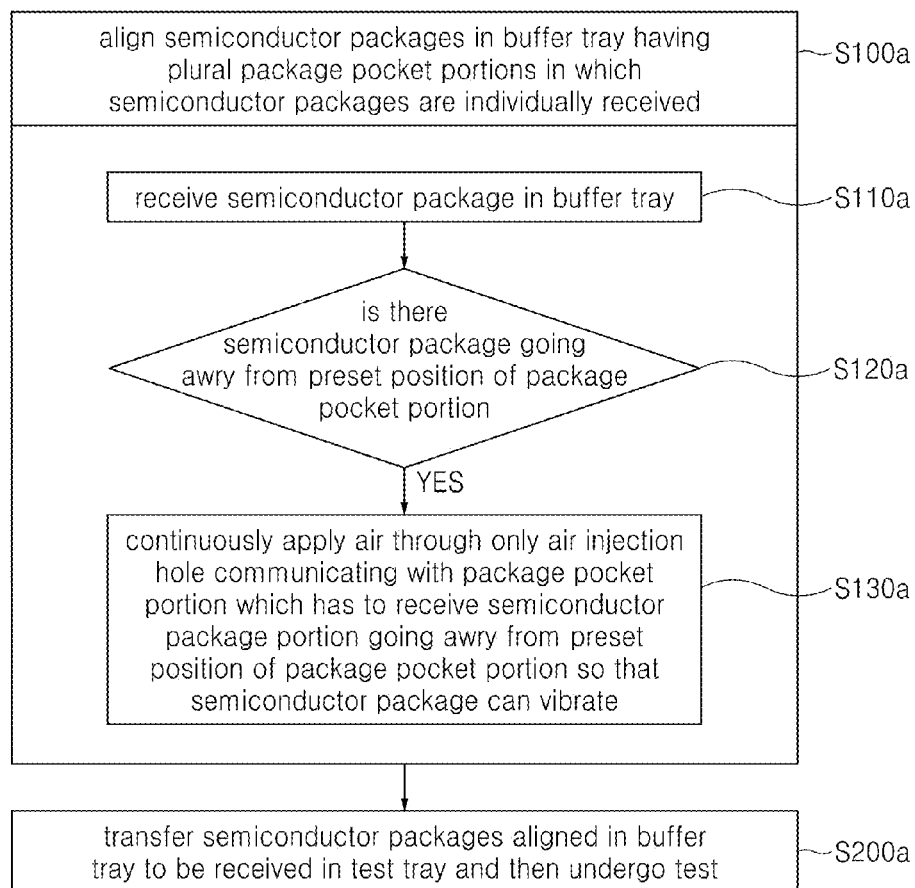


FIG. 9



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**TRAY FOR ALIGNING SEMICONDUCTOR
PACKAGES AND TEST HANDLER USING
THE SAME, AND METHOD OF ALIGNING
SEMICONDUCTOR PACKAGES AND TEST
METHOD USING THE SAME**

**CROSS-REFERENCE TO RELATED
APPLICATIONS**

This application claims the priority of Korean Patent Application No. 10-2013-0028588, filed on Mar. 18, 2013, in the Korean Intellectual Property Office, the contents of which is incorporated herein by reference.

FIELD

The inventive concept relates to a tray for aligning semiconductor packages, a test handler using the same, a method of aligning the semiconductor packages, and a test method using the same, and more particularly to a tray for aligning semiconductor packages, a test handler using the same, a method of aligning the semiconductor packages, and a test method using the same, in which the semiconductor package is free from defective seating.

BACKGROUND

During a semiconductor manufacturing process, if a semiconductor package is completely assembled, individual semiconductor packages are transferred to undergo a process, for example, described herein. A semiconductor manufacturing process requires that many semiconductor packages are transferred at the same time or many semiconductor packages are precisely aligned.

A semiconductor integrated circuit provided in the form of a chip on a semiconductor wafer is reprocessed in the form of a package, where the chip is protected from an external shock, while experiencing a series of packaging processes. The completely processed semiconductor package undergoes a package test process in which an electric final test is performed prior to delivery to a user. A tester where various measuring devices are mounted to a computer, and a handler for automatically transferring and connecting the semiconductor package to the tester are used, and such facilities are collectively referred to a test handler.

In brief, a test handler operates as follows. If a customer tray (C-tray) receiving the semiconductor packages is loaded at an entrance of a loading part, then the semiconductor packages on the customer tray are transferred to and received again on the buffer tray (B-tray) by a picking head or the like. Then the semiconductor packages received on the buffer tray are received again in a test tray (T-tray) suitable for the test by the picking head or the like. Thereafter, the test tray is transferred to a test site and thus the semiconductor packages undergo the test.

Here, the test handler may need to transfer the semiconductor packages from the customer tray (C-tray) to the buffer tray. Conventionally, the buffer tray provided with a pocket portion for guiding an outskirt of the package has been used to transfer and align the semiconductor packages, and an inner wall forming the pocket portion is inclined so that the semiconductor package can enter the pocket portion along an inclined surface when being received in the pocket portion even though the semiconductor package goes slightly awry.

However, if many semiconductor packages are transferred and received at a high speed, the semiconductor

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package may sometimes go awry from the pocket portion. In this case, the whole test handler is suspended, and after the semiconductor packages are manually received in a proper position of the pocket portion or removed, the test handler is restarted, thereby lowering productivity.

Also, the pocket portion of the buffer tray has to be manufactured to have a larger size than the semiconductor package in order to prevent the semiconductor package from getting jammed with respect to an outskirt size tolerance, and therefore, a problem may occur where the semiconductor may go awry with respect to a predetermined position within the pocket portion of the buffer tray.

As above, the buffer tray is described by way of example. However, a conventional tray for aligning the semiconductor packages has problems in that the facilities are suspended to take manual measures since it has no automatic compensation function even though the semiconductor package goes awry with respect to the pocket portion. It is difficult to normally load the semiconductor package at a fine pitch since difficulties can arise in order to provide precise position alignment needed corresponding to the semiconductor package.

SUMMARY

The inventive concept provides a tray for aligning semiconductor packages, a test handler using the same, a method of aligning the semiconductor packages, and a test method using the same, in which the semiconductor package that may sometimes go awry while the semiconductor packages are individually transferred can be aligned to a proper position, and degree of precision in the proper position of the package can be more improved than that of a conventional case.

According to an aspect of the inventive concept, there is provided a tray for aligning semiconductor packages. The tray comprises a tray main body comprising a plurality of package pocket portions at which a plurality of semiconductor packages are individually received; and an air position-aligning unit coupled to the tray main body. The air position-aligning unit applies air having a preset pressure to the semiconductor package received at the package pocket portion. The semiconductor package is aligned at the package pocket portion.

In some embodiments, the air position-aligning unit comprises an air channel in the tray main body that communicates with the package pocket portion and is provided in the tray main body to connect with an air injection hole for injecting the air; and an air pump that supplies the air to the air channel.

In some embodiments, the air injection hole is provided at a center region of a bottom wall of the tray main body.

In some embodiments, the tray further comprises a diffusion groove which is recessed from a surface about the air injection hole at the bottom wall, the diffusion groove communicating with the air injection hole, the diffusion groove having a cross-section area that is reduced it extends upward.

In some embodiments, each air injection hole is connected to one air channel.

In some embodiments, the air position-aligning unit further comprises a controller which controls the air pump to continuously supply air by a preset time to the air channel when the semiconductor packages to be tested are loaded into the tray main body, so that the semiconductor packages can vibrate.

In some embodiments, the tray main body comprises: a body portion which comprises the package pocket portion and a receiving groove formed in a lower portion of the package pocket portion; and a package supporter which is arranged in the receiving groove of the body portion, and supports the semiconductor package received in the package pocket portion, and the air injection hole is formed in the package supporter.

In some embodiments, the package supporter comprises: a package supporting frame which is relatively movably coupled to the body portion; and a shock-absorbing member, which is interposed between the body portion and the package supporting frame and absorbs a shock applied to the package supporting frame.

In some embodiments, the plurality of package pocket portions each comprises an inclined surface on an inner wall of the tray main body forming the package pocket portion so that a cross-section area of each package pocket portion gradually narrows as it extends from a top opening to a bottom surface.

In some embodiments, the tray further comprises a buffer tray which is transferred from a customer tray loaded with the semiconductor packages to be tested and that receives the semiconductor packages.

According to an aspect of the inventive concept, there is provided a test handler comprising a tray for aligning semiconductor packages, in which the semiconductor packages are received. The tray comprises a tray main body which comprising a plurality of package pocket portions in which semiconductor packages are individually received; and an air position-aligning unit which is connected coupled to the tray main body. The air position-aligning unit applies air having a preset pressure to a semiconductor package received in the package pocket portion so that the semiconductor package can be aligned in the package pocket portion.

In some embodiments, the air position-aligning unit comprises at least one air injection hole in the tray main body; an air channel in the tray main body, the air channel communicating with the at least one injection hole for injecting the air; and an air pump which supplies the air to the air channel so that the semiconductor package can vibrate when the semiconductor packages to be tested are loaded in the tray main body.

In some embodiments, the air injection hole is provided in a center region of a bottom wall of the tray main body forming the package pocket portion.

In some embodiments, the test handler further includes a diffusion groove which is recessed from a surface around the air injection hole of the bottom wall to communicate with the air injection hole, and has a cross-section area getting smaller as going upward.

In some embodiments, the air position-aligning unit further includes a controller which controls the air pump to continuously supply air by preset time to the air channel when the semiconductor packages to be tested are loaded into the tray main body, so that the semiconductor packages can vibrate.

In some embodiments, the tray main body comprises a body portion which comprises the package pocket portion and a receiving groove formed in a lower portion of the package pocket portion; and a package supporter which is arranged in the receiving groove of the body portion, and supports the semiconductor package received in the package pocket portion, and the air injection hole is formed in the package supporter.

In some embodiments, the package supporter comprises: a package supporting frame which is relatively movably

coupled to the body portion; and a shock-absorbing member which is interposed between the body portion and the package supporting frame and absorbs a shock applied to the package supporting frame.

In some embodiments, the plurality of package pocket portions each comprises an inclined surface on an inner wall of the tray main body forming the package pocket portion so that a cross-section area of each package pocket portion can get gradually narrower as going from a top opening to a bottom surface.

In some embodiments, the test handler comprises a buffer tray which is transferred from a customer tray loaded with the semiconductor packages to be tested and receives the semiconductor packages.

According to another aspect of the inventive concept, there is provided a method of aligning semiconductor packages, comprising receiving the semiconductor packages in the tray for aligning the semiconductor packages, which comprises a plurality of package pocket portions in which the semiconductor packages are individually received; and applying air having preset pressure to the semiconductor package received in the package pocket portion so as to align the semiconductor package.

In some embodiments, applying the air having the preset pressure comprises continuously applying air by preset time through an air injection hole formed in a tray main body provided with the package pocket portion of the tray for aligning the semiconductor packages so as to communicate with the package pocket portion so that the semiconductor packages can vibrate.

In some embodiments, applying the air having the preset pressure comprises ascertaining whether there is a semiconductor package that goes awry with respect to a preset position of the package pocket portion; and applying air to an air injection hole communicating with the package pocket portion which has to receive the package pocket portion going awry from the preset position, so that the semiconductor package can vibrate.

According to another aspect of the inventive concept, there is provided a test method for semiconductor packages, comprising aligning the semiconductor packages in the tray for aligning the semiconductor packages, which comprises a plurality of package pocket portions in which the semiconductor packages are individually received; and transferring the aligned semiconductor packages to a test tray, wherein aligning the semiconductor package comprises: receiving the semiconductor package in the tray for aligning the semiconductor packages; and applying air having preset pressure to the semiconductor package received in the package pocket portion so as to align the semiconductor package.

In some embodiments, applying the air having the preset pressure comprises continuously applying air by preset time through an air injection hole formed in a tray main body provided with the package pocket portion of the tray for aligning the semiconductor packages so as to communicate with the package pocket portion so that the semiconductor packages can vibrate.

In some embodiments, applying the air having the preset pressure comprises ascertaining whether a semiconductor package goes awry with respect to a preset position of the package pocket portion; and applying air to an air injection hole communicating with the package pocket portion which has to receive the package pocket portion going awry from the preset position, so that the semiconductor package can vibrate.

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According to another aspect of the inventive concept, there is provided a test handler, comprising: a buffer tray that aligns a plurality of semiconductor packages to be tested. The buffer tray comprises a tray main body having a plurality of package pocket portions in which the semiconductor packages are individually received; and an air position-aligning unit coupled to the tray main body, the air position-aligning unit applying air to each of the semiconductor packages to be received in the package pocket portions for aligning semiconductor packages in the package pocket portions. The test handler further comprises a loader unit that transfers the semiconductor packages from the buffer tray to a test tray.

In some embodiments, the air position-aligning unit comprises: an air channel in the tray main body that communicates with the package pocket portion and is provided in the tray main body to connect with an air injection hole for injecting the air; and an air pump that supplies the air to the air channel.

In some embodiments, the air position-aligning unit further comprises a controller which controls the air pump to continuously supply air by preset time to the air channel when the semiconductor packages to be tested are loaded into the tray, main body, so that the semiconductor packages can vibrate.

In some embodiments, the tray main body comprises: a body portion which comprises the package pocket portion and a receiving groove formed in a lower portion of the package pocket portion; and a package supporter which is arranged in the receiving groove of the body portion, and supports the semiconductor package received in the package pocket portion, and the air injection hole is formed in the package supporter.

In some embodiments, the plurality of package pocket portions each comprises an inclined surface on an inner wall of the tray main body forming the package pocket portion so that a cross-section area of each package pocket portion can get gradually narrower as going from a top opening to a bottom surface.

BRIEF DESCRIPTION OF THE DRAWINGS

Exemplary embodiments of the inventive concept will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a schematic plan view of a test handler according to an embodiment of the present inventive concept;

FIG. 2 is a partial perspective view of the test handler of FIG. 1;

FIG. 3 is a perspective view of a buffer tray used in the test handler of FIG. 1 as a tray for aligning semiconductor packages according to an embodiment of the present inventive concept;

FIG. 4 is an enlarged perspective view of an 'A' region of FIG. 3;

FIG. 5 is a plan view showing an air channel inside the buffer tray of FIG. 3 with a hidden line;

FIG. 6 and FIG. 7 are views illustrating processes of aligning the semiconductor packages vibrated by air in the buffer tray of FIG. 3;

FIG. 8 is a flowchart for a test method of the semiconductor packages according to an embodiment of the present inventive concept; and

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FIG. 9 is a flowchart for a test method of the semiconductor packages according to another embodiment of the present inventive concept.

DETAILED DESCRIPTION OF THE INVENTION

Specific structural or function descriptions of embodiments according to the present inventive concept disclosed in this specification or application are illustrated just for explaining embodiments according to the present inventive concept. The embodiments according to the present inventive concept can be realized in various forms, and have not to be interpreted as limited to the embodiments explained in the present specification or application.

The embodiments according to the present inventive concept may be variously changed and have many forms, and therefore the present specification or application will be described in detail with exemplary embodiments illustrated in the drawings. However, this is not to limit the embodiments of the present inventive concept to a certain disclosed form, and it has to be understood that the embodiments involve all the modifications, equivalents or substitutes without departing from the idea and technical range of the present inventive concept.

The terms such as 'first' and/or 'second', etc. can be used in explaining various elements, but the elements have not to be limited by the foregoing terms. The above terms have to be given only for distinguishing one element from another element, and for example, a first element may be named a second element, and vice versa, without departing from the scope of the present inventive concept.

If it is described that a certain element is "connected" or "coupled" to a different element, it may be directly connected to or coupled to the different element, but it has to be also understood that an additional element may be interposed between the above elements. On the other hand, if it is described that a certain element is "directly connected" or "directly coupled" to a different element, it has to be understood that no element may be interposed between the elements. Other representations for explaining a relationship between the elements, e.g., "between ~" and "directly in between ~", "near to ~" and "directly near to", or the like have to be interpreted likewise.

The terms used in the present specification are used just for explaining certain embodiments, and are not intended to limit the present inventive concept. A singular form involves a plural form as long as it is not differently defined in the context. In this specification, it will be appreciated that "comprise", "have" or the like terms are just used for designating the presence of feature, numerals, steps, operations, elements, parts or combinations thereof, without excluding possibility of the presence or addition of one or more features, numerals, steps, operations, elements, parts or combinations thereof.

As long as it is not defined differently, all the terms used herein including technical or scientific terms have the same meaning as those generally understood by a person having an ordinary skill in the art to which the present inventive concept pertains. Also, terms defined in a generally used dictionary have to be interpreted as meaning equivalent to contextual meaning of the related technology, and have not to be interpreted as ideal or excessively formal meaning as long as they are clearly defined in this specification.

Hereinafter, the inventive concept will be described in detail by explaining embodiments of the inventive concept

with reference to the attached drawings. Like reference numerals in the drawings denote like elements.

The present inventive concept is applicable to various trays for aligning the semiconductor packages, a test handler using the same, a method of aligning the semiconductor packages and a test method using the same, but for convenience of description, a buffer tray (B-tray) will be described below as the tray for aligning the semiconductor packages.

FIG. 1 is a schematic plan view of a test handler according to an embodiment of the present inventive concept. FIG. 2 is a partial perspective view of the test handler of FIG. 1.

As shown therein, a test handler for a semiconductor device according to an embodiment of the present inventive concept includes a main body **100**, a loader unit **600** for supplying a semiconductor package to be tested, an unloader unit **700** for unloading the semiconductor package of which the test is completed, a soak chamber **200** for preheating or precooking the semiconductor package at a predetermined temperature, a test chamber **300** for testing the semiconductor package loaded on a test tray **330**, and an exit chamber **400** for returning the tested semiconductor package to an initial room temperature state.

In this embodiment, the test handler employs a buffer tray **800** as a tray for aligning the semiconductor package to be tested, described in detail herein.

The main body **100** couples with the loader unit **600**, the unloader unit **700**, the soak chamber **200**, the test chamber **300** and the exit chamber **400**. The main body **100** can serve as a frame or related structure for supporting the foregoing.

The loader unit **600** includes a loading stocker (not shown), a loading-side set plate **610**, and a loading Cartesian robot **620**. The loading stocker provided in front of the main body **100** is stocked with the customer trays (C-trays) **630** where many semiconductor packages to be tested are loaded.

The customer trays **630** stocked in the loading stocker are sequentially transferred to the loading-side set plate **610** by a transfer arm (not shown). As shown in FIG. 2, the loading Cartesian robot **620** includes a first picking head **621** and a second picking head **622**. The first picking head **621** transfers the semiconductor packages from the customer tray **630** to the buffer tray **800**. The second picking head **622** transfers the semiconductor packages from the buffer tray **800** to a test tray **330**.

The semiconductor packages are at the buffer tray **800** before being transferred to the test tray **330** because length/breadth pitches of the package pocket portions **812** provided in the customer tray **630** and accommodating the semiconductor packages are generally different from the length/breadth pitches of the package pocket portions **812** provided on the test tray **330** arranged for a test process in a test site. Therefore, if the first picking head **621** directly transfers the semiconductor packages accommodated in the package pocket portion **812** of the customer tray **630** to package pocket portions of the test tray **330**, then the pitches between them are not matched and control of the robot is not easy, resulting in a loss in work.

Similar to the loading unit, the unloader unit **700** includes an unloading stocker (not shown), an unloading-side set plate **710**, and an unloading Cartesian robot **720**. At one side of the loading stocker is provided the unloading stocker where the tested semiconductor packages are sorted in accordance with test results and accommodated in the customer tray **630**. Also, the customer trays **630** placed on the unloading-side set plates **710** are also sequentially transferred to the unloading stocker by the transfer arm (not shown).

The unloading Cartesian robot **720** includes a third picking head (not shown) and a fourth picking head (not shown). The third picking head transfers the semiconductor packages from the test tray **330** to an unloading buffer tray **730**. The fourth picking head transfers the semiconductor packages from the unloading buffer tray **730** to the customer tray **630**. As an alternative to providing a unloading buffer tray **730**, an unloader unit may in other embodiments be provided without the unloading buffer tray **730**.

In brief, the loading stocker stocked with a plurality of customer trays **630** receiving the semiconductor packages to be tested and the unloading stocker stocked with the customer trays **630** receiving the semiconductor packages tested and sorted according to grades are respectively arranged in front of the main body **100**. Further, the loading-side set plate **610** and the unloading-side set plate **710** are respectively arranged on the loading stocker and the unloading stocker as waiting places for loading and unloading the semiconductor packages.

Further, the loading Cartesian robot **620** and the unloading Cartesian robot **720** continuously and repetitively move between the test trays **330** via the customer tray **630** and the buffer tray **800**. Thus, the loading Cartesian robot **620** transfers the semiconductor package to be tested from the customer tray **630** to the test tray **330** via the buffer tray **800**. The unloading Cartesian robot **720** transfers the tested semiconductor package from the test tray **330** to the customer tray **630** via the unloading buffer tray **730**.

The test tray **330** is repetitively circulated while sequentially moving to a waiting region of a loader stage **640** before entering the soak chamber **200**. The test tray **330** sequentially moves between soak chamber **200**, the test chamber **300**, the exit chamber **400**. The test tray **330** moves to the unloader stage **740** which is at a region proximal the exit chamber **400**, and where the test tray **330** is positioned before moving to the loader stage **640** after exiting the exit chamber **400**.

In the loader stage **640**, the test tray **330** waits for loading the semiconductor package to be tested. The unloader stage **740** includes a sorting region where the tested semiconductor package waits to be sorted. A buffer region where an empty test tray **330** waits to be supplied to the loader stage **640**.

To circulate the test tray **330**, the test handler according to an embodiment of the present inventive concept includes a conveyor for circulating the test tray **330** in between the loader stage **640**, the soak chamber **200**, the test chamber **300**, the exit chamber **400** and the unloader stage **740**, and further includes a main controller for controlling the conveyor. The soak chamber **200**, the test chamber **300** and the exit chamber **400** are provided at a back region of the main body **100**.

The test tray **330** loaded with the semiconductor package moves in a direction from the soak chamber **200** to the exit chamber **400**. Here, the soak chamber **200** serves to previously heat or cool the test tray **330** loaded with the semiconductor package at a predetermined temperature before transferring the test tray **330** to the test chamber **300**.

Further, the exit chamber **400** serves to return the tested semiconductor package from the test chamber **300** to the initial room temperature state.

The test chamber **300** uses a test plate to electrically connect the respectively semiconductor packages loaded on the test tray **330** with test sockets (not shown) of a test board under the test conditions, i.e., under conditions where a high or low temperature is maintained, thereby performing the test.

When the semiconductor packages are transferred and received in the buffer tray **800** from the customer tray **630** receiving the semiconductor packages, a conventional test handler has a known problem where the test handler is suspended to take manual measures since it has no automatic compensation function even in situations where the semiconductor package goes awry with respect to the package pocket portion **812** of the buffer tray **800**. In particular, it is difficult to normally load the semiconductor package at a fine pitch since a precise position alignment needed corresponding to the semiconductor package is difficult to attain.

In an embodiment, a buffer tray **800** is provided for aligning the semiconductor packages is configured as follows, and can address and resolve the foregoing problem associated with conventional test handlers.

FIG. **3** is a perspective view of a buffer tray **800** used in the test handler of FIG. **1** as a tray for aligning semiconductor packages according to an embodiment of the present inventive concept, FIG. **4** is an enlarged perspective view of an 'A' region of FIG. **3**. FIG. **5** is a plan view showing an air channel inside the buffer tray **800** of FIG. **3** with a hidden line. FIG. **6** and FIG. **7** are views illustrating processes of aligning the semiconductor packages vibrated by air in the buffer tray **800** of FIG. **3**.

As shown herein, the buffer tray **800** can be used as a tray for aligning semiconductor packages according to an embodiment of the present inventive concept. The buffer tray **800** includes a tray main body **810** having a plurality of package pocket portions **812** at which semiconductor packages are individually received. As shown in FIGS. **6** and **7**, the buffer tray **800** also includes an air position-aligning unit **850** connected to the tray main body **810**, the air position-aligning unit **850** applying air having predetermined or preset pressure to the semiconductor package to be received in the package pocket portion **812**, thereby aligning semiconductor packages in the package pocket portion **812**. In this embodiment, when the air position-aligning unit **850** applies the air to the semiconductor package, the semiconductor package vibrates, resulting in an alignment in the package pocket portion **812**.

The tray main body **810** forms an outer appearance of the buffer tray **800**. The tray main body **810** may have an integrated block structure, i.e., a single structure as necessary. In embodiments, where the tray main body **810** is formed as the integrated block structure, a shock may be applied to the semiconductor package when the semiconductor package is received in the package pocket portion **812**.

Accordingly, in order to absorb the shock applied to the semiconductor package when the semiconductor package is accommodated in the package pocket portion **812**, the tray main body **810** includes a body portion **820** provided in a lower portion of the package pocket portion **812** and formed with a receiving groove **822**, and a package supporter **830** arranged in the receiving groove **822** of the body portion **820** that provides a support for the semiconductor package received in the package pocket portion **812**.

Further, the package supporter **830** includes a package supporting frame **831** relatively movably coupled to the body portion **820** and a shock-absorbing member **835** interposed between the body portion **820** and the package supporting frame **831**. The shock-absorbing member **835** is constructed and arranged to absorb a shock applied to the package supporting frame **831**.

In some embodiments, a spring may be used as the shock-absorbing member **835**, and the package supporting frame **831** can include the spring installation groove **832**

recessed to receive the spring. In some embodiments, the spring installation groove **832** is formed coaxially with the air channel **860**, but not limited thereto. Alternatively, the spring installation groove **832** may be spaced apart from the air channel **860** and formed in the package supporting frame **831**. The number of spring installation grooves may vary without limitation.

Further, the package supporting frame **831** may be formed of the same material as the body portion **820** or formed of a different material than the body portion **820**.

With this configuration, during operation when the semiconductor package is received in the package pocket portion **812**, the package supporter **830** may absorb a shock for safe seating with respect to semiconductor packages. Particularly, in this embodiment, if air is applied to a semiconductor package by the air position-aligning unit **850**, then the semiconductor package vibrates. Notwithstanding the possibility of collisions occurring between the semiconductor package and the package supporter **830**, such vibration can absorb the shock.

Also, each package pocket portions **812** can include an inclined surface **821** on an inner wall forming the package pocket portion **812** so that its cross-section area can gradually narrow from a top opening to a bottom surface. Thus, when the semiconductor package is received in the package pocket portion **812**, the semiconductor package can enter along the inclined surface **821** despite the possibility of misalignment, for example, in cases where the semiconductor package moves slightly awry.

The air position-aligning unit **850** can include at least one air injection hole **852** formed in the tray main body **810**, i.e., in the package supporting frame **831** of the package supporter **830**. The air position-aligning unit **850** can also include an air channel **860** provided in the tray main body **810** and communicating with the air injection hole **852**, an air pump (not shown) supplying air to the plurality of air channels **860**, and a controller (not shown) for controlling the air pump to continuously supply air to the air channel **860** according to a predetermined time so that the semiconductor package can vibrate when the semiconductor packages to be tested are loaded in the tray main body **810**.

In an embodiment, the air injection hole **852** is formed in the tray main body **810** and is provided in every package pocket portion **812** to communicate with each package pocket portion **812**, for aligning the semiconductor package anywhere in the package pocket portion **812**.

In an embodiment, the air injection holes **852** of the plurality of package pocket portion **812** are as shown in FIG. **5** connected to one air channel **860**, but not limited thereto. Alternatively, each region may be divided and the air channel may be provided in every divided region to simultaneously supply air.

In an embodiment, an air injection hole **852** is provided in a center region of a bottom wall of the tray main body **810** forming the package pocket portion **812**. The air injection hole **852** is provided in this manner because the semiconductor packages can be more efficiently aligned when the air injection hole **852** is provided in the center region of the bottom wall of the tray main body **810**, but not limited thereto. Alternatively, the air injection hole **852** may be provided in regions other than the center region of the bottom wall of the tray main body **810** as long as the semiconductor packages are at least substantially aligned.

Thus, in embodiments where the air injection hole **852** is provided in the center region of the bottom wall of the tray main body **810** and injects a relatively very small amount of air upward, the semiconductor package can be vibrated

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(shaken) while slightly floating off within the package pocket portion **812**, for example, shown in FIG. **6** and FIG. **7**. At this time, if the semiconductor package goes awry or otherwise becomes misaligned, it can return to a proper position during operation. Also, a movable range of the semiconductor package can be restricted within the package pocket portion **812**, and thus the semiconductor package can be more precisely aligned than a conventional case.

In an embodiment, the air injected through the air injection hole **852** of each package pocket portion **812** has the same pressure. Therefore, the air injection hole **852** formed in the bottom wall of the tray main body **810** forming the package pocket portion **812** in accordance with the air channel **860** may have the same size or related configuration, or the package pocket portions **812** may be different in the size or related configuration of the air injection hole **852** in accordance with distances from an air inlet **861**. In this manner, air can be injected with the same pressure even though it is further distant from the air inlet **861** of the air channel **860**.

Further, a diffusion groove **834** can be formed around the air injection hole **852** on the bottom wall of the tray main body **810**. The diffusion groove **834** can be recessed with respect to the surface to communicate with the air injection hole **852** and has a cross-sectional area that is reduced as it extends in an upward direction. This is to diffuse the air from the air injection hole **852** to a predetermined region, thereby preventing the air from being intensively applied to the semiconductor package.

In this embodiment, the controller controls the air pump to continuously supply air to the air channel **860** by a relatively short time so that the semiconductor package can vibrate when the semiconductor packages to be tested are loaded in the tray main body **810**. Like this, the semiconductor package may vibrate and thus be automatically aligned in the package pocket portion **812**.

In this embodiment, the controller does not ascertain whether the semiconductor package is properly aligned in the package pocket portion **812**, and controls the air pump to continuously supply air to the air injection hole **852** by a relatively short time. This is because the time for supplying the air is so short that the air is directly provided when the semiconductor package is loaded in the buffer tray **800**, thereby not only aligning the semiconductor package going awry, but also more precisely aligning the semiconductor package as compared to that of a conventional case even though the semiconductor package does not go awry.

In this embodiment, the controller controls the air pump to continuously supply air to the air injection hole **852** by a relatively short time, but not limited thereto. Alternatively, the air pump may be controlled to discontinuously supply air as long as the semiconductor package is effectively aligned.

A method of aligning the semiconductor package according to an embodiment of the present inventive concept and a test method for the semiconductor package using the same will now be described with reference to FIG. **8** in addition to FIG. **1** to FIG. **7**.

At step **S100**, a semiconductor package is aligned in the buffer tray **800** having the plurality of package pocket portions **812** individually receiving the semiconductor package, and step **S200** refers to a transferring and testing the aligned semiconductor package.

The step **S100** of aligning the semiconductor package in the buffer tray **800** includes a set of steps. In particular, step **S100** includes a step **S110** of receiving the semiconductor package in the buffer tray **800**, and a step **S130** of applying air having a predetermined pressure to the semiconductor

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package received in the package pocket portion **812** in order to align the semiconductor package.

In more detail, one customer tray **630** stocked on the loading stocker is transferred to the loading-side set plate by the transfer arm. A plurality of semiconductor packages on the customer tray **630** are loaded into the respective package pocket portions **812** of the buffer tray **800** by the loading Cartesian robot (**S110**).

When the plurality of semiconductor packages are loaded into the respective package pocket portions **812** of the buffer tray **800**, the semiconductor package may go awry with respect to the buffer tray **800**. It may be ascertained whether the semiconductor package goes awry. However, in this embodiment, when the plurality of semiconductor packages are loaded into the respective package pocket portions **812** of the buffer tray **800**, air having the predetermined pressure is injected to the whole package pocket portions **812** via the air injection hole **852** according to a predetermined time without ascertaining whether the semiconductor package goes awry.

The air injected to the air injection hole **852** collides with the semiconductor package loaded into each package pocket portion **812**, so that the semiconductor package vibrates, thereby aligning the semiconductor package (**S130**).

Then, at step **S200**, the aligned semiconductor package is transferred and tested. In more detail, when the semiconductor package is aligned in the buffer tray **800**, the second pickup head loads the semiconductor package from the buffer tray **800** to the test tray **330**.

The test tray **330** loaded with a plurality of semiconductor packages is transferred to the soak chamber and heated or cooled at a temperature for the test conditions, thereby being transferred to the test chamber.

In the test chamber, the plurality of semiconductor packages on the test tray **330** are connected to test sockets, thereby performing the test. Then, the tested test tray **330** is transferred to the exit chamber **400**.

The test tray **330** returns to a room temperature while passing through the exit chamber **400**, and is sorted with regard to grades by the unloading Cartesian robot **720** in accordance with test results. The test tray **330** is then moved to the customer tray **630** placed in the unloading-side set plate **710**.

If the empty customer tray **630** placed in the unloading-side set plate **710** is fully occupied with the semiconductor packages, then the customer tray **630** is transferred to and stocked in the unloading stocker by the transfer arm in accordance with various grades. Then, the transfer arm transfers a new empty customer tray **630** to the unloading-side set plate **710**.

FIG. **9** is a flowchart for a test method of the semiconductor packages according to another embodiment of the present inventive concept. Here, a method of aligning the semiconductor package according to this embodiment of the present inventive concept and a test method for the semiconductor package using the same will be described with regard to only different parts from those of FIG. **8**.

In this embodiment, at step **S100a**, the semiconductor package is aligned in the buffer tray **800**. Step **S100a** includes ascertaining whether there is a semiconductor package going awry from a preset position of the package pocket portion **812** (**S120a**), and aligning the semiconductor package by applying air to only the air injection hole **852** communicating with the package pocket portion **812** from which the semiconductor package goes awry. Thus, a step of vibrating the semiconductor package (**S130a**) occurs, as distinguished from the foregoing embodiment. However, a

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step S110a of receiving the semiconductor package in the buffer tray 800, and a step S200a of transferring and testing the aligned semiconductor package are the same as those of the foregoing embodiment.

Meanwhile, the foregoing embodiments illustrate that the buffer tray 800 is used as the tray for aligning the semiconductor packages, but not limited thereto. Alternatively, the tray for aligning the semiconductor packages may be applied to the test tray 330.

According to embodiments of the inventive concept, the semiconductor package that may sometimes go awry while the semiconductor packages are individually transferred can be aligned to a proper position, and degree of precision in the proper position of the package can be more improved than that of a conventional case.

While the inventive concept has been particularly shown and described with reference to exemplary embodiments thereof, it will be understood that various changes in form and details may be made therein without departing from the spirit and scope of the following claims.

What is claimed is:

1. A tray for aligning semiconductor packages, the tray comprising:

a tray main body comprising a plurality of package pocket portions at which a plurality of semiconductor packages are individually received; and

an air position-aligning unit coupled to each of the plurality of package pocket portions of the tray main body, the air position-aligning unit applying air having a preset pressure to a semiconductor package of the plurality of semiconductor packages received at a package pocket portion of the plurality of package pocket portions, wherein the semiconductor package is aligned at the package pocket portion by the application of air by the air position-aligning unit directly to the semiconductor package in the package pocket portion.

2. The tray according to claim 1, wherein the air position-aligning unit comprises

an air channel in the tray main body that communicates with the package pocket portion and is provided in the tray main body to connect with an air injection hole for injecting the air; and

an air pump that supplies the air to the air channel.

3. The tray according to claim 2, wherein the air injection hole is provided at a center region of a bottom wall of the tray main body and receives the air from the air position-aligning unit.

4. The tray according to claim 3, further comprising a diffusion groove which is recessed from a surface about the air injection hole at the bottom wall, the diffusion groove communicating with the air injection hole, the diffusion groove having a cross-section area that is reduced it extends upward.

5. The tray according to claim 2, wherein the air injection hole is connected to one air channel.

6. The tray according to claim 2, wherein the air position-aligning unit further comprises a controller which controls the air pump to continuously supply air by a preset time to the air channel when the semiconductor packages to be tested are loaded into the tray main body, so that the semiconductor packages can vibrate.

7. The tray according to claim 1, wherein the tray main body comprises:

a body portion which comprises the package pocket portion and a receiving groove formed in a lower portion of the package pocket portion; and

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a package supporter which is arranged in the receiving groove of the body portion, and supports the semiconductor package received in the package pocket portion, and

the air injection hole is formed in the package supporter.

8. The tray according to claim 7, wherein the package supporter comprises:

a package supporting frame which is relatively movably coupled to the body portion; and

a shock-absorbing member, which is interposed between the body portion and the package supporting frame and absorbs a shock applied to the package supporting frame.

9. The tray according to claim 1, wherein the plurality of package pocket portions each comprises an inclined surface on an inner wall of the tray main body forming the package pocket portion so that a cross-section area of each package pocket portion gradually narrows as it extends from a top opening to a bottom surface.

10. The tray according to claim 1, further comprising a buffer tray which is transferred from a customer tray loaded with the semiconductor packages to be tested and that receives the semiconductor packages.

11. A test handler comprising:

a tray for aligning semiconductor packages, in which the semiconductor packages are received, the tray comprising:

a tray main body comprising a plurality of package pocket portions in which semiconductor packages are individually received; and

an air position-aligning unit coupled to each of the plurality of package pocket portions of the tray main body, the air position-aligning unit applying air having a preset pressure to a semiconductor package received in the package pocket portion so that the semiconductor package can be aligned in the package pocket portion by the application of air by the air position-aligning unit directly to the semiconductor package in the package pocket portion.

12. The test handler according to claim 11, wherein the air position-aligning unit comprises:

at least one air injection hole in the tray main body;

an air channel in the tray main body, the air channel communicating with the at least one injection hole for injecting the air; and

an air pump which supplies the air to the air channel so that the semiconductor package can vibrate when the semiconductor packages to be tested are loaded in the tray main body.

13. The test handler according to claim 12, wherein the air injection hole is provided in a center region of a bottom wall of the tray main body forming the package pocket portion.

14. The test handler according to claim 13, further comprising a diffusion groove which is recessed from a surface around the air injection hole of the bottom wall to communicate with the air injection hole, and has a cross-section area getting smaller as going upward.

15. The test handler according to claim 12, wherein the air position-aligning unit further comprises a controller which controls the air pump to continuously supply air by preset time to the air channel when the semiconductor packages to be tested are loaded into the tray main body, so that the semiconductor packages can vibrate.

16. The test handler according to claim 11, wherein the tray main body comprises:

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a body portion which comprises the package pocket portion and a receiving groove formed in a lower portion of the package pocket portion; and
 a package supporter which is arranged in the receiving groove of the body portion, and supports the semiconductor package received in the package pocket portion, and

the air injection hole is formed in the package supporter.

17. The test handler according to claim 16, wherein the package supporter comprises:

a package supporting frame which is relatively movably coupled to the body portion; and

a shock-absorbing member which is interposed between the body portion and the package supporting frame and absorbs a shock applied to the package supporting frame.

18. The test handler according to claim 11, wherein the plurality of package pocket portions each comprises an inclined surface on an inner wall of the tray main body forming the package pocket portion so that a cross-section area of each package pocket portion can get gradually narrower as going from a top opening to a bottom surface.

19. The test handler according to claim 11, comprising a buffer tray which is transferred from a customer tray loaded with the semiconductor packages to be tested and receives the semiconductor packages.

20. A test handler, comprising:

a buffer tray that aligns a plurality of semiconductor packages to be tested, the buffer tray comprising:

a tray main body having a plurality of package pocket portions in which the semiconductor packages are individually received; and

an air position-aligning unit coupled to each of the plurality of package pocket portions of the tray main body, the air position-aligning unit applying air to each of the semiconductor packages to be received in the package pocket portions for aligning semicon-

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ductor packages in the package pocket portions by the application of air by the air position-aligning unit directly to the semiconductor package in the package pocket portion; and

a loader unit that transfers the semiconductor packages from the buffer tray to a test tray.

21. The test handler according to claim 20, wherein the air position-aligning unit comprises:

an air channel in the tray main body that communicates with the package pocket portion and is provided in the tray main body to connect with an air injection hole for injecting the air; and

an air pump that supplies the air to the air channel.

22. The test handler according to claim 20, wherein the air position-aligning unit further comprises a controller which controls the air pump to continuously supply air by preset time to the air channel when the semiconductor packages to be tested are loaded into the tray main body, so that the semiconductor packages can vibrate.

23. The test handler according to claim 20, wherein the tray main body comprises:

a body portion which comprises the package pocket portion and a receiving groove formed in a lower portion of the package pocket portion; and

a package supporter which is arranged in the receiving groove of the body portion, and supports the semiconductor package received in the package pocket portion, and

the air injection hole is formed in the package supporter.

24. The test handler according to claim 20, wherein the plurality of package pocket portions each comprises an inclined surface on an inner wall of the tray main body forming the package pocket portion so that a cross-section area of each package pocket portion can get gradually narrower as going from a top opening to a bottom surface.

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